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THE SONGS OF THE GRASSHOPPERS.

BY S. H. SCUDDER.

ALTHOUGH every one is familiar with the notes of birds, few can distinguish the different chirpings of insects, or are even aware that every kind of Grasshopper has its distinctive note. The songs of insects are neither so varied nor complicated as those of birds, but their study presents peculiar difficulties. Sounds become inaudible to many persons when they are derived from vibrations more rapid than 25,000 per second, and when the number reaches 38,000, the limit of human perceptibility is attained: thus, the shrillness of a note may prove a hinderance to its study. This is illustrated by Tyndall in his recent book on Sound. He writes: "Crossing the Wengern Alp with a friend, the grass on each side of the path swarmed with insects, which, to me, rent the air with their shrill chirruping. My friend heard nothing of this, the insect world lying beyond his limit of audition."

Another and universal obstacle lies in the delicacy or feebleness of the notes of some species; to distinguish them

clearly, one must bring his ear to within a few feet, or even inches of the insect during its stridulation,—a process which requires great caution lest the shyness of the little violinist should overcome his egotistic love of song. The observer must walk quietly toward the sound until it ceases, and wait motionless for its renewal; the direction of the chirping can then easily be determined, although its distance is deceptive. After drawing an imaginary line towards the spot from whence the sound proceeds, cautious steps must be taken around the arc of a wide circle until another line is fixed at right angles to the first, and the location of the songster approximately determined. Then walking quickly but quietly to within five or six feet of the insect, the observer will fall upon his hands and knees, and produce a quill edge and file, which, on being rubbed together, imitate, with great exactness, the desired note. He will commence his mock stridulation after a short delay; at first the sounds must be subdued and separated by considerable intervals, then loud, and repeated in quick succession; usually a response is heard before a minute has elapsed, and sometimes it comes at once. When the insect has forgotten his fears and begins to stridulate violently, the observer may cease operations and carefully approach him. In this way one can place himself within a few inches of any species living in the grass.

Grasshoppers stridulate in four different ways: first, by rubbing the base of one wing-cover upon the other, using, for that purpose, the veins running through the middle portion of the wing; second, by a similar method, but using the veins of the inner part of the wing; third, by rubbing the inner surface of the hind legs against the outer surface of the wing-covers; and fourth, by rubbing together the upper surface of the front edge of the wings and the under surface of the wing-covers. The insects which employ the fourth method stridulate during flight,—the others while at rest. To the first group belong the Crickets; to the second

the Green or Long-horned Grasshoppers; to the third and fourth, certain kinds of Short-horned or Jumping Grasshoppers. The sounds produced by the different groups vary in pitch, those of the crickets being shrillest and the others following in the order just given. With but few exceptions the males alone sing.

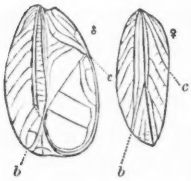
The notes of the Cricket—called by the French "cri cri" on account of its song—may be heard near Boston* from the middle of June until November; further north they do not appear until much later in the season. Their note is *crrri*, and the rapidity with which it is uttered varies even in the same strain; sometimes it is as slow as two notes a second, at others it is twice as rapid. The note is sharp and shrill, and appears to be pitched at E natural, two octaves above middle C. Sometimes two choirs of these insects may be heard at once, the individuals of each choir chirping simultaneously, but one choir more rapidly than the other; most of the time this produces a sort of discord, but, as they occasionally harmonize, one hears cycles of accordance and discordance, often of remarkable uniformity and duration.

The Spotted-cricket (*Nemobius vittatus*) appears simultaneously with the Black-cricket (*Gryllus niger*). The chirping of the two insects is very similar, but that of the former may be better expressed by *r-r-r-u*, pronounced as though it were a French word. The note is trilled forcibly, and lasts a variable length of time. One of these insects was once observed while singing to its mate. At first the song was mild and frequently broken; afterwards it grew impetuous, forcible, and more prolonged; then it decreased in volume and extent until it became quite soft and feeble. At this point the male began to approach the female, uttering a series of twittering chirps; the female ran away, and the male, after a short chase, returned to his old haunt, singing with the same vigor but with frequent pauses; at last, finding all persuasion unavailing he brought his serenade to a close.

* All my illustrations are drawn from New England insects.

In September and October, the White Climbing-cricket (*Œcanthus niveus*, Fig. 1, left wing-cover of male, Fig. 1 *a*, the same of female*) is found on the leaves of low trees and bushes. It makes a uniform note, exceedingly shrill but attenuated.

Fig. 1. Fig. 1 *a*.



The peculiar development of the wing in stridulating Orthoptera is nowhere seen to better advantage than in this insect. In the female, the veins of the central field run nearly parallel to the border; in the male, they cross the wing in various directions, and either converge toward the point of stridulation on the inner border of the wing, where the inner and central fields meet, or act as supports to the converging veins.

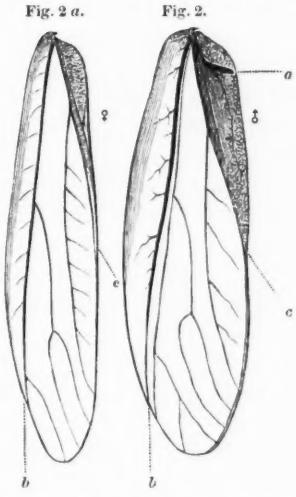
All these insects belong to the first class. There are many species in the second group (the green or long-horned grasshoppers), but a few examples will suffice. These insects, like the crickets, sing both by day and night, but, unlike the latter, their day-song differs from that of the night. On a summer's day, it is curious to observe these little creatures suddenly changing from the day to the night-song at the mere passing of a cloud, and returning to the old note when the sky is clear. By imitating the two songs in the daytime, the grasshoppers can be made to respond to either at will; at night, they have but one note.

The previous illustrations showed that the stridulating organ of crickets occupied the middle field of the wing; in the green grasshoppers, on the contrary, it will be found in the inner field; here, too, the relative size of the inner field is nearly the same in both sexes, but the stout, curved vein of the male is altogether wanting in the voiceless female.

One of them, the *Phaneroptera curvicauda* (Fig. 2, male;

* In all the illustrations, the dotted lines show the limitations of the different fields of the wing; *a* represents the "file;" *b* points at the line of separation between the costal (or outer) and central fields; *c*, at that point between the central and inner fields.

Fig. 2 *a*, female), prefers to sing in the night. His day-song is *bzrwi*, and lasts one-third of a second; the night-song consists of a repetition—ordinarily eight times—of a note which sounds like *tchw*. This is repeated at the rate of five in three-quarters of a second, making each note one-half as long as that of the day.



The song of the common Meadow-grasshopper (*Orchelimum vulgare*) is more complicated. Commencing with *ts*, it changes almost instantly into a trill of *zr:* at first there is a crescendo movement which reaches its volume in half a second; the trill is then sustained for a period varying from one to twenty seconds, and closes suddenly with *p*. This strain is followed by a series of staccato notes, sounding like *jip;* they are one-eighth of a second in length, and are produced at one-half second intervals. The staccato notes and the trill alternate *ad libitum*. The night-song differs from that of the day simply in its slower movement; the pitch of both is at B flat, two octaves above middle C.

A conical-headed grasshopper (*Conocephalus robustus*), found near the seashore in the southern part of New England, makes the salt marshes resound with its incessant, shrill din. The resemblance of its song to that of the harvest-fly is quite striking; at a distance, the note seems to be perfectly uniform; close at hand, one can hear it rising and falling rhythmically, two and a half times a second, accompanied by a loud droning noise.

There are numerous kinds of jumping grasshoppers which stridulate in the daytime only. They do this by the aid of

the hind legs, rubbing their thighs against their wing-covers; every movement of the fiddle-bow produces a short note, and the uniformity with which each species plays its own song is quite remarkable. One kind (*Stenobothrus curtipennis*) produces about six notes per second, and continues them from one and a half to two and a half seconds; another (*S. melanopleurus*) makes from nine to twelve notes in about three seconds. In both cases the notes follow each other uniformly, and are slower in the shade than in the sun.

The stridulating apparatus of the jumping grasshoppers is of a very different character from that of the green grasshoppers. In *Arcyptera lineata* (Fig. 3, left wing of male; Fig. 3 *a*, left wing of female), for example, it is situated in the central field of the wing, which is of about the same size in both sexes; some of the veins in the centre of the wing (*a*, enlarged in Fig. 3 *b*) have a rasp-like surface upon which the hind thighs are scraped up and down, producing monotonous, nearly uniform notes.

Fig. 3. Fig. 3 *a*.

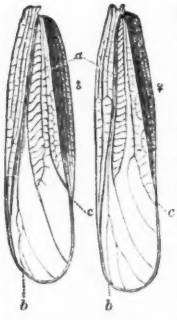
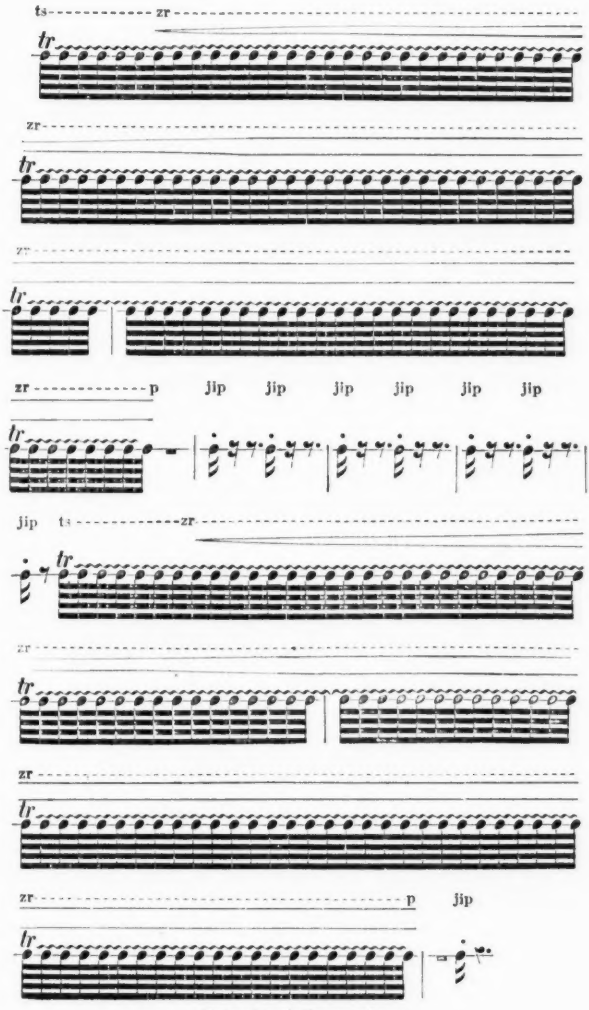


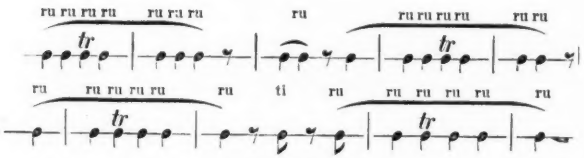
Fig. 3 *b*.

The grasshoppers which stridulate during flight, by the contact of the wings and wing-covers, belong mostly to the genus *Œdipoda;* in many of them the wings are variegated with brilliant colors. The sound which they make seems to be under the control of the insects, for they often omit it when alarmed. Some species produce a uniform, rattling noise during the whole of their undeviating flight; others make it only during the intervals of flight, and seem to stridulate more at will. The flight of the latter is more sustained, they are capable of changing their course, and at each turn emit a crackling sound of short duration.

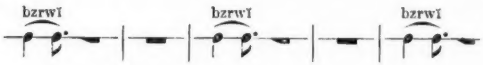


Note of Orchelimum vulgare.

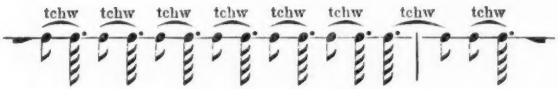
Note of Gryllus neglectus.



Note of Nemobius vittatus.

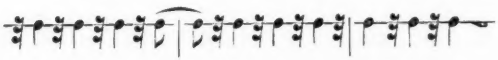


Note of Phaneroptera curvicauda by day.

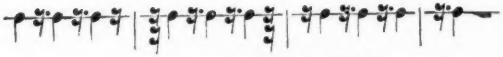


Note of Phaneroptera curvicauda by night.

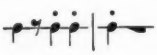
Note of Stenobothrus melanopleurus in the sun.



Note of Stenobothrus melanopleurus in the shade.



Note of Stenobothrus curtipennis.



Note of Arcyptera lineata.

BEARS AND BEAR-HUNTING.

BY CHARLES WRIGHT.

"NOTES of a Hunter," by Henry Clapp, call to mind some personal experience about bears and bear-hunting in Texas. I was much in the company of Mr. Benjamin Burke, a very observing, intelligent, and truthful man. He imparted to me many items of information respecting the habits of the bear. Some of these habits I had the opportunity of observing myself, and I have full confidence in the truth of his statements relative to the others.

I had read in my youth, in some great encyclopedia, that the bear goes to his winter's sleep very fat, and awakes from it, in the spring, very lean. I was surprised then to learn, that, so far as can be judged by appearances, he loses none of his fat during hibernation. Of course, in his wild state we cannot weigh him before going to sleep and after he wakes. The hunter says he goes to his winter-quarters "full fat," and comes out "full fat." *I* know that he is fat when he begins to travel in the spring; but he becomes lean rapidly, notwithstanding he may find plenty to eat. At this period, he is destructive to hogs; indeed, all the summer, till the return of mast (acorns, grapes, and other autumn fruits) offers him better food. Mr. Burke had a very large, gentle boar (he was raised as a pet) which was caught by a bear; but he broke away, and came to the house with a gaping wound just over the middle of his back. A *gang* of hogs will rally, in self-defence, against a wolf, a panther, or any other animal of this country that I know of, except a bear. If you want to scatter a gang, throw among them a bit of fresh bear-skin. Apropos of this a story is told, for the truth of which I do not vouch, though I think it not improbable, that a man's hogs being in the habit of breaking into his neighbor's field, the latter caught one, sewed it up in the skin of a bear newly killed, and turned it loose among

its fellows. These ran for dear life, and the bear-hog followed from social instinct till both fell, if not dead, at least quite exhausted.

I was not aware that a bear can climb a tree so small as that mentioned by Mr. Clapp. The hunter knows whether the animal is in the hollow of the tree above by the marks of the claws. In ascending, he leaves only the puncture of the claws. In descending, he makes long scratches. They climb in order to "lap," as the hunter says, described by Mr. Clapp as drawing in branches to get the fruit. I feel inclined to doubt whether they break off the branches *for the purpose of throwing them down and then descending to eat the fruit.* It looks too much like human reasoning. If the branch breaks, he may not be able to hold it; and when he goes down, he may eat the fruit. This would be all natural enough. In the South, acorns form the principal mast. They are fond of persimmons too, and grapes. When mast is not plenty, they lap black-gum berries (*Nyssa multiflora?*), and these impart to the flesh, not a bitter taste, as would naturally be supposed, but the peculiar savor of fish; so that, for a person of delicate taste, only severe hunger will force him to eat the meat of a bear that has lapped black-gum.

The female commonly climbs a tree to find a hollow for her winter-quarters, where she has her cubs. I was present at the taking of one from such a hollow. It was necessary to climb a neighboring tree; then a piece of dry rotten wood set on fire, loosely attached to a pole and thrust into her nest, soon forced her to turn out. Old, large bears do not like to climb, and generally hibernate in a thick bunch of cane or bushes, or among some fallen tree-tops, or in a hollow log, making a bed of leaves, grass, brush, or other stuff. During winter, if a warm day occurs, bears will sometimes go out and walk about, and perhaps drink; but they, probably, do not eat. One killed during the winter has nothing, or only a little mucus in the stomach and intestines, and the plug in the vent, as mentioned by Mr. Clapp.

This results, probably, from the hardening of the last fecal matter, mostly mucus, which comes from the intestines. But the idea that it is composed of gum,—an idea that I never heard of in Texas,—entertained by some, reminds me of another custom of bears, probably connected with the sexual heat. In some localities, particularly on a high bluff near a stream, a pine tree is occasionally seen, from which the bark, at a certain height, is plainly torn off by the teeth of some animal. It is said to be done by the bear in this manner: he rises on his hind feet with his back to the tree, and, turning his head to one side and to the other, rips off the bark with his tusks. The size of the animal is known, approximately, by the height of the marks he leaves. The same tree is visited year after year by bears of various sizes,—none very small, however. I would say, trusting to memory, that the average height may be about four feet. I have seen several such trees. I think Mr. Burke had never witnessed this performance, but received his information from Indians. I never saw any other than a pine thus marked.

Bears are fond of honey, and will rob bee-hives, if within reach. They also dig up "yellow-jackets," wasp's-nests, for the larvæ. The account of this is amusing. The animal digs rapidly, and when the insects sting him too fiercely he quits for a moment, rolls over and over on the ground, snarling the while, and returns again to the attack, perhaps to go through the same movements several times before he bears off the prize.

It is exciting sport hunting bears with dogs. These come to be almost as fond of it as the hunter himself. Most of them, in the beginning, fear to attack, and some never get the better of the dread he inspires. A fierce one is apt to spring at the ear, to his sorrow. But the dog that has courage and prudence combined bites him behind, which he will by no manner of means tolerate, but will wheel to fight. I doubt if he ever properly strikes with his paws. He makes

his own instinctive effort to seize the attacking party, and to put him in the place of the lowermost dog in the fight. Then he bites, and if he gets the dog by the back, and if this be a lean thin dog, woe be to the dog. A fat one has a better chance. The bear cannot so well get his broader back into his mouth, and, the skin slipping, he generally escapes with only a flesh-wound. Dogs, at first, often refuse bear-meat, but come to prefer it before all others, as does the hunter.

When hard pressed, the bear will back into a dense patch of cane or into a bunch of bushes, and, standing erect on his hinder parts, make the best fight he is capable of. This is the time for the hunter, when his attention is absorbed by the dogs. Occasionally one is started, which runs steadily on and escapes. Females and young commonly climb, or "tree" in hunters' dialect. Generally, they are then easily shot; but sometimes, on the hunter's approach, they will drop from the tree and run on again.

I once met a female and two cubs. I shot the mother fair in the breast, aiming at the white spot. The cubs treed, and I killed them; I then went in search of the old one, fully expecting to find her, close by, dead. As she ran away she bled profusely, but the blood grew less, and finally stopped entirely, and I never found the bear. How she could go quite off with such a loss of blood, was a mystery.

THE GEOGRAPHICAL DISTRIBUTION OF ANIMALS.

BY SIDNEY I. SMITH.

(Concluded from page 23.)

AMONG terrestrial and fluvial species, topography is much more powerful in limiting geographical distribution, than it is among marine species. The separation of lands by broad ocean waters, without change of temperature, is sufficient to

prevent the mingling of their land faunæ to any extent, while they may have most of their marine species in common. Such cases are numerous; at the Galapagos, for instance, none of the truly land species are known to occur in any other region, while a large portion of the marine species are found also on the American coast. Temperature is undoubtedly the most effective cause in limiting the diffusion of land and fresh water, as well as marine animals; but its influences are much obscured by those of humidity, and by the varying character of soils, waters, and the resulting vegetation.

Temperature, as a result of or combined with topography, forms a very effective force in limiting the distribution of land animals. High and continuous mountain ranges present an almost impassable barrier to the migration of most species. Thus the physical features which separate faunæ from regions east and west may be so strongly marked, that they more than counterbalance the climatic effects of latitude. In North America, the faunæ on the east of the Rocky Mountains are very different from those on the west, and the inclosed central table-lands are occupied by still different faunæ. The birds of Arizona resemble those of the table-land of Mexico rather than those of California or of Texas. These physical features even effect a change in the migrations of the birds of this region; many of the birds of the Colorado valley, instead of migrating far to the north in summer, turn to the east and breed in the region north of Fort Whipple.*

Climatic influences, almost alone, limit the distribution of mountain vegetation; and, through the vegetation, more than directly that of mountain animals. The narrow limits within which mountain species are restricted show very plainly the effect of climatic influences. Among the butterflies of the White Mountains of New Hampshire, the abundant *Chionobas semidea* Edw., is restricted to the loftiest summit, never

* Dr. E. Coues, Prodrome of a work on the Ornithology of Arizona Territory, noticed in the NATURALIST, Vol. I, p. 209.

breeding without these narrow limits, although frequently blown into the lower vallies. In a zone below these lofty summits, but not extending to the base of the mountains, *Argynnis Montinus* Scudd. is found, yet never at the summit with the *Chionobas*, nor about the base with the species of the Canadian or Virginian faunæ.* Many other species of insects, and many plants, are restricted in the same manner. It cannot be that these species are thus restricted in their distribution merely by some primary, innate principle, which prevents their diffusion; for, like their marine relatives, they have not always been thus restricted.

It is not so easy to trace these migrations of species on the land as it is in the ocean, for land species are not so often left fossil in their ancient homes; and, as there are no authentic records of land animals existing through the Glacial epoch, we can go back no farther than its decline. Yet it is worthy of remark, that the arctic land fauna of the Tertiary period, like the marine, was probably circumpolar; and that the gradually advancing cold of the glaciers would have driven many arctic plants and animals southward, and, living just beyond the border of the ice belt, they would have followed it back with the glacial decline.

At the close of the Glacial epoch, the fauna and the flora of New England must have been very much like that of the coast of Labrador at the present time. As the climate became gradually warmer, the more hardy species would have retreated northward and up the mountain sides, while others less hardy, became extinct during these climatic changes. As the migration continued, the mountain summits were left as aërial islands in the more southern faunæ.†

The known land fossils of this period of change are as yet very few, but the faunal migration has left abundant evidence in the northern species scattered along its path

* S. H. Scudder, Remarks on some Characteristics of the Insect Fauna of the White Mountains. Journal of the Boston Society of Natural History, Vol. VII.

† Packard, Glacial Phenomena of Labrador, p. 256.

upon the mountains, or wherever the climatic or topographical influences have not annihilated them.

The flora of the higher mountains of New England and the Middle States is quite identical with that of higher North American latitudes. All the plants of the White Mountains are now growing upon the coast of Labrador. As might be expected, the fauna of these mountains agrees with the flora. The larger animals would not, of course, be expected to occur in so restricted an area; still, one or two northern birds are found in summer, and many species of insects—Coleoptera, Diptera, Lepidoptera, and Orthoptera—are common to the mountains and places farther north. There are, however, some forms which appear to be peculiar to the mountain fauna, but more careful and extended investigation in the northern regions may prove many or even all of them to belong to species still existing at the north.

The plants and the birds of the coast of Maine, where the cooling effect of the arctic current is still felt, are subarctic in character, and very different from those inland. *Potentilla tridentata* and *Alsine Grœnlandica*,* species characteristic of the flora of Labrador and the New England mountain summits, with *Pupilla badia*, still linger as far south as Portland. Thus upon the land, as in the ocean, there are southern outliers of northern faunæ which are relics of the northern march of life during the close of the Glacial period.

The influence of winds in animal distribution is very slight, and seems wholly a disturbing power; yet it should not be passed over in silence, for it helps explain the wonderfully wide diffusion of a few species. The winds may transport animals great distances, even over oceans, and drop them alive among the species of other faunæ. Several of our American birds have been carried thus to Europe so

* At Paris, Maine, about forty miles north of Portland, and just on the coast line of the Leda Clay epoch, I have found both these arctic plants springing from the gravel in a railway cut, as if to mark their home of a former age. The occurrence of *Sedum Rhodiola* in Bucks county, Pennsylvania, mentioned by Professor Porter in this volume of the NATURALIST, p. 39, is a much more interesting relic of the Glacial epoch.

often, that they are now catalogued as British species, although they are never known to breed there; and European species have frequently been taken upon the American coast. It is not very probable that land birds have crossed the Atlantic in this way and become established in the opposite country, but in the case of northern aquatic birds, it is by no means impossible that whole flocks may have crossed the ocean, and become inhabitants of both shores of the Atlantic. Most of the birds that are common to Europe and North America are arctic aquatic species. With insects there is a still greater chance of being carried from country to country by winds. That they have never been known to cross the ocean, as birds, is very poor evidence that they do not do so, for hundreds might arrive yearly and not be noticed. Insects have frequently come upon vessels at great distances from land, and there is no reason why they should not be carried by winds as far as birds. Once arrived in a new country, the chances of their becoming permanently established are very much greater than for birds, for a single female with eggs might be sufficient to introduce the species. Some of the facts mentioned below in regard to the introduction of insects through man's agency, show how easily they may become established.

Of the organic causes in animal distribution, the influence of animals themselves is very slight compared with that of man. Still, many species, carried by the winds or by man's influence from their original homes into other regions, are destroyed by native carnivorous species, their permanent introduction prevented, and the mingling of far-separated faunæ somewhat lessened. The effect produced by animals in diffusing other species is perhaps greatest in carrying parasites from place to place. A species is seldom introduced without some of its parasites, and it might even introduce them without becoming introduced itself, for parasited cocoons and eggs of insects, or living insects and other animals infested by parasites, might be carried great dis-

tances, and the parasites thus introduced attack other species.

Man, with boundless aspirations and governed in all things by an influence within himself, is given a power in nature second only to his Creator; with control over physical causes, he is governed by no laws of geographical distribution, and, traversing the whole earth at his will, he has carried, in spite of climatic influences, species from continent to continent, and almost from pole to pole. His influence—far above all other secondary causes, and uncontrolled by the laws imposed upon mere animals—seems only a disturbing force among the naturally harmonizing laws of the diffusion of life. Many of the changes which man has wrought in the distribution of animals are so evident and so universally understood, that it is useless to refer to them here, and we will allude only to some of those which bear more directly upon our understanding of the geographical distribution of species.

By changes in the minor physical features of regions, man has often adapted them to species of other regions. The Cliff-swallow was formerly known only from far west of the Mississippi, where there were extensive limestone cliffs for it to nest upon; but now that the buildings of man have made places for its habitation, it has spread from the Mississippi all over the Atlantic States.*

The New Potato-beetle (*Doryphora 10-lineata*), which is so destructive in the West, was long ago known at the base of the Rocky Mountains in Colorado, feeding upon a wild species of *Solanum* peculiar to that region. Civilization, pushing westward, at last extended its fields of cultivated plants far west of the Mississippi into this region. The potato (a species of *Solanum*) was well adapted to feed the beetle, and was of course attacked by it. The broad fields of cultivated plants were much better fitted for its increase than the scattered wild ones, and it rapidly diffused itself

* A. E. Verrill, Proceedings of the Boston Society of Natural History, Vol. IX, p. 276.

eastward. In 1864 it had crossed the Mississippi, and now it has covered half of the State of Illinois.*

Three common species of butterflies in Eastern North America, — *Vanessa Antiopa*, *Cynthia cardui*, and *Cynthia Atalanta*, — long known to be identical with European species, have been asserted to be natives of this country, and the possibility of their introduction from Europe has recently been questioned.† But, within a very few years, there has been a well-authenticated instance of the naturalization of an European butterfly in Canada. *Pieris Rapæ*, the Cabbage-butterfly of Europe, was introduced at Quebec about 1859, and, in 1863, it had become very abundant within a circle of forty miles radius about that city.‡ If butterflies are introduced and spread so rapidly now, there is no reason why the other butterflies mentioned, all of which feed upon introduced plants, should not have been introduced and diffused over all the eastern part of the country long before entomologists began to study the distribution of species.

Man's influence is perhaps more noticeable in restricting the range of, or wholly destroying many species of animals. Within a few centuries several of the largest birds have become extinct through his agency, the larger wild animals have been mostly driven from civilized countries, the relative abundance of the different classes of animals has been materially changed, and the natural harmony which must have prevailed in the distribution of life has been destroyed, for man cannot change the relative abundance of a single species without affecting indirectly myriads of animals.

If man has wrought such vast changes within the short period of our written history, what must be the sum of all his influence in past ages? Is it too much to say that his influence aided in the extermination of those monsters of the

* B. D. Walsh, Practical Entomologist, October, 1865, and November, 1866.

† Ibid., On certain Entomological Speculations of the New England School of Naturalists. Proceedings of the Entomological Society of Philadelphia, Vol. III, p. 207.

‡ G. J. Bowles, On the Occurrence of Pieris rapæ in Canada. Canadian Naturalist, Vol. I, No. 4, August, 1864.

last geological epoch, the Mastodon, the Irish Elk, the Cave-bear, and all those wonderful animal forms that passed away with the appearance of man?

THE PRONG-HORN ANTELOPE.

BY W. J. HAYS.

THE PRONG-HORN ANTELOPE.
From Tenney's Zoology.

In a recent number of the NATURALIST is a letter from Dr. Coues on the animals of our Western plains. Among other quadrupeds he describes the *Antilocapra Americana*, or Prong-horn Antelope, and says that they do not shed their horns. It is somewhat strange, that, although this animal has been known so long, so little is known of its habits.

A few years since Professor Baird received a letter from Dr. Canfield, who had spent some years among these animals, announcing the fact the antelope did actually shed its horns.

As this animal has always been supposed to belong to that class of ruminants called hollow-horned, the same as the cow, sheep, and goat, Professor Baird looked upon the statement as a delusion of the writer's, and paid no farther attention to the matter, until, in 1865, a young male antelope was taken to the Zoölogical Gardens of London; this was the first animal of the kind ever taken to Europe.

One morning the keeper discovered that one of the horns

was loose, and, supposing that some injury had been done to the animal, he immediately called for Mr. Bartlett, the superintendent of the garden, when, upon further examination, they found that both of the horns were about to fall off. This was the first account published of this interesting fact. The account will be found in the Proceedings of the Zoölogical Society of London for 1865.

For the last four years I have had an antelope under my own observation, and have watched carefully the process of development of the horns.

The antelope fawns are born in the spring, and when six months old the horns first begin to develop. They continue to grow until the next October or November (that is, until

The horn just shed. A longitudinal section showing the manner in which the hairs pass through the horn. The appearance of the horn in the month of January. Its appearance in April.

the animal is eighteen months old), when the first pair of horns are shed; by this is meant the outside shell. Like the cow and sheep there is a horn-core formed by the prolongation of the frontal bone, and occupying about two-thirds of the interior of the horn. When the horn drops off, the horn-core is found covered with a thick skin, and coated with hair, the same as the face of the animal, with a small portion of the tip having already begun to harden; this acting as a wedge, forces the horn off.

Fig. 1.

Fig. 2.

THE PRONG-HORN ANTELOPE.

The new horn continues to grow from the tip downwards, and generally to curve inwards; at the same time the thick skin below continues to harden, at first assuming the appearance of black leather. It is flexible, so that the tip may be bent in any direction; a prong sprouts from the base, and, by the middle of summer, the horns are fully developed, to be dropped and again renewed in the autumn.

The horn, when shed, seems to be a mass of agglutinated hairs enclosed by a substance resembling whalebone in appearance; some of the hairs, however, never amalgamating with the horn, but retaining their natural condition, and, passing entirely through the horn, will be found protruding on the inside and outside of the horn.

The animal, from which I have made the drawings, is now developing his fourth pair of horns. The second pair of horns were about three inches longer than the first, and the same difference existed between the second and third pair.

EXPLANATION OF PLATE 3.

Fig. 1. The animal in October, immediately after shedding the horns.
Fig. 2. Appearance in August, the horns being perfect.

DO SNAKES SWALLOW THEIR YOUNG?

BY F. W. PUTNAM.

"WELLSVILLE, N. Y., Sept. 4, 1867.

"EDITORS AMERICAN NATURALIST:

"SIRS, — A short time since I was in Condersport, Pa., in whortleberry time, and a man who had been out berrying stated that he suddenly came across a Rattlesnake with her young, some twenty-six, * about her.

* In regard to the number of snakes in a brood, very little is known. Twenty-six seems to be rather a large number for a Rattlesnake, taking my own observations as a guide, for of two female Rattlesnakes (*Crotalus durissus*) which I dissected, one had nine and the other eight fully formed eggs in the oviducts, though there were a number of small ones (not quite as large as peas) which had probably been impregnated and might have become developed before the others were excluded, but which appeared to

She immediately opened her mouth, and instantly the whole family of little ones went down her throat. Do you believe it? Is that the nature of the Rattlesnake? — H. M. S."

THE above question has been often asked, and we have several times received statements similar to that expressed in the foregoing letter, which, while difficult to believe, it is hard to doubt without questioning the veracity of a large number of persons, and it seems to the writer that the principal point to prove now is, *Do young snakes, after entering the throat of their parent, come out again alive?*

In answer to this last form of the question we can say, that frogs *can* live some time in the œsophagus of a snake; and if so, why cannot young snakes do the same? for apparently snakes have as great a power as frogs to live under circumstances that would deprive more highly organized animals of life. — To my proof about the frog:

Last summer Mr. Hyatt met with a common Striped-snake which had recently enjoyed a meal, indicated by a large bunch near the centre of the body. Mr. Hyatt was led, by the very common desire which most naturalists have of

me as if they belonged to a second brood. In a specimen of a closely allied genus (*Crotalophorus miliarius*) fourteen eggs were counted in the oviducts, each egg containing an embryo about two inches in length, in which the fangs were developed. In a specimen of the common Striped-snake (*Tropidonotus sirtalis*) thirty-five inches in length, collected on the 22d of July, I found forty-two nearly developed young in the oviducts, each of which was five and a half inches in length, making a combined length nearly equal to seven times the total length of the parent. July 13th I caught a female of the Garter-snake, as it is often called in Massachusetts (*Tropidonotus sauritus*), which had nine eggs, each of which was three-fourths of an inch in length, and contained an embryo two and a half inches long. On July 31st I captured another of the same species which had evidently just excluded part of her brood, as there were but four eggs in the oviducts just ready to be burst by the young. These eggs were each one inch and a quarter in length, and contained young measuring five and a half inches. On August 30th, I found the eggs of the common Green-snake (*Coluber vernalis*), seven in number, just under the old bark and moss of a decayed stump in a meadow. These eggs, which were just on the point of hatching (one young was already partly out of the egg, and two others came out before I reached home), were an inch in length by half an inch in diameter, and the young snakes were five and thirteen one hundredths inches long. Several years ago a family of twenty-two young Water-adders (*Tropidonotus sipedon*), each about eight inches in length, were found together and presented to the Museum of Comparative Zoölogy, Cambridge, by Dr. Chaplin. These few notes are all that I have relating to the time of breeding of our snakes and the number of eggs to a brood, and I can assure any of the readers of the NATURALIST who feel disposed to collect female snakes during June, July, August, and September, that they would be very acceptable to our collection.

experimenting on animals that come in their way, to try the temper of the snake, which he did by teazing it with a stick. This amusement, in a short time, apparently made the snake sick, and the "bunch" was observed to move towards the head. In a few moments more *a live frog* was seen trying to get out of the snake's mouth*, which, after a hard trial and a good many jerks and kicks, it succeeded in doing, and jumped off highly delighted at making its escape from such close and uncomfortable quarters. This little incident proves that a frog can live a considerable time in the œsophagus of a snake; and any one desirous of witnessing the power which snakes have of maintaining life under equally trying circumstances, need only attempt to drown one, or kill it by placing it in a tight jar. If, instead of making the cruel experiment, the reader will take our word for it we can assure him that snakes have been known to live for some time immersed in water, and "bottled up" in alcohol.

Thus, with the above facts before us, what reason have we to doubt that young snakes can live in the dilatable throat of their mother long enough for her to carry them to a place of safety? and why should not young snakes have this means of protection given to them? It is really a provision no more wonderful than that with which young kangaroos, opossums, and other marsupial mammals are provided in the pouch of their mothers; or the young pipe-fishes and sea-horses in the singular pouch or abdominal fold of their fathers, into which the young go for protection or for rest.†

One might easily believe, that, if the old snake should take the young into her throat in a moment of danger, she might afterwards, on being pressed by hunger, be strongly tempted to work them down a little farther and provide herself with a good dinner already at hand, especially as large

* Rana palustris.

† I have seen the young of our common Pipe-fish (*Syngnathus Peckianus*), kept in an aquarium, go in and out of the "pouch" of the male fish.

snakes are known to feed on smaller ones;* and that it would be almost too much to expect that an animal, which to our higher natures seems so cold in its disposition, would stop to consider the fact that it was her own children she had in her throat before forcing them into her empty stomach. But here again are we met with facts that should set this doubt at rest; for certainly we must allow that her Snakeship is as highly endowed with motherly feeling as several species of fishes which live in the waters of South America, and which are known to carry their eggs in their mouths until they are hatched, and the young have attained considerable size; and yet, though the mouths of these fishes are so full of eggs or young that they cannot take food without either unloading their mouths or swallowing their eggs, yet they are not known to swallow eggs which they have taken in charge. With this well-known case of forbearance on the part of fishes, are we not justified in believing that snakes would have an equally motherly regard for their offspring?

It has been given as a reason against the probability of snakes taking their young into their throats, that the gastric juice would destroy the life of the young ones in a short time; but this is not the case, as we know from the instance of the frog that life is not immediately destroyed. The gastric juice, too, would not affect any animal until it was received within the stomach, and probably not even then until life was destroyed by suffocation.

The belief that the young of several species of snakes do enter the mouth of the parent for protection, has prevailed for a long time, and, in many countries. A similar belief is very prevalent among sailors and sea-faring men, regarding many species of sharks which are thought to take their young into the mouth to protect them from danger.†

* On opening a large Black-snake (*Coluber constrictor*), a full-sized Green-snake (*Coluber vernalis*), and a full-sized Brown-snake (*Tropidonotus occipitomaculatus*), were found in its stomach and adjoining part of the œsophagus, with those portions in the stomach in a slightly decomposed condition.

† Some sailors believe that the young sharks, which are often seen to suddenly dis-

In a conversation with Professor Wyman some time since, that eminent physiologist stated that he did not know any reason why young snakes could not live for a time in the throat of the parent, and also called my attention to the prevalence of the belief in former times by a quotation from Spenser's "Faerie Queene," in the first canto:

XIV.

"But, full of fire and greedy hardiment,
The youthfull Knight could not for ought be staide;
But forth unto the darksome hole he went,
And looked in: his glistring armor made
A litle glooming light, much like a shade;
By which he saw the ugly monster plaine,
Halfe like a serpent horribly displaide,
But th' other halfe did womans shape retaine,
Most lothsom, filthie, foule and full of vile disdaine.

XV.

"And as she lay upon the durtie ground,
Her huge long taile her den all overspred,
Yet was in knots and many boughtes upwound,
Pointed with mortall sting: Of her there bred
A thousand young ones, which she dayly fed,
Sucking upon her poisnous dugs; each one
Of sundrie shapes, yet all ill-favored:
Soon as that uncouth light upon them shone,
Into her mouth they crept, and suddain all were gone.

* * * * * * * *

XXV.

"Her scattred brood, soone as their parent deare
They saw so rudely falling to the ground,
Groning full deadly all with troublous feare
Gathred themselves about her body round,
Weening their wonted entrance to have found
At her wide mouth; but being there withstood,
They flocked all about her bleeding wound,
And sucked up their dying mothers bloud;
Making her death their life, and eke her hurt their good."

We have quite recently received from Mr. Cooke, the editor of "Science-Gossip," London, several of his instruc-

appear while swimming about the parent fish, are taken into the mouth of the parent, while others think that they enter at the genital opening.

tive and interesting little works on popular Natural History, and among them "Our Reptiles"* which contains such confirmations of some of the statements given in this short sketch, and so many well-authenticated accounts of snakes taking their young into their mouths for protection, that we quote the following passages.

On page 50, in writing on the food of the common English Snake, which is the European representative of the common Striped-snake of America, and closely allied to it in its habits, he gives the following quotation from Mr. Bell: "I once saw a very small one [frog], which had been swallowed by a large snake in my possession, leap again out of the mouth of the latter, which happened to gape, as they frequently do immediately after taking food." And again on the same page he writes: "During the present summer, a gentleman of our acquaintance saw a lad kill a snake in the wood. It was a very large one, and the boy cut it open along the under surface with his pocket-knife. By this means a full-sized frog was liberated from the stomach of the snake. It was very lively and soon hopped away. Why may not young vipers remain as long with equal ease in the stomach of their parent?"

On page 68, in treating of the venom of Vipers, he mentions the following case of a Horned-viper presented to Dr. Guyon in Algeria: "This reptile had been put into a bottle, which had since remained hermetically closed. It had been in there for six weeks, without food and without air, and looked quite dead, since it could not stir in the bottle, which it filled entirely. And yet, on opening the bottle, the

* OUR REPTILES. A plain and easy account of the Lizards, Snakes, Newts, Toads, Frogs, and Tortoises indigenous to Great Britain. By M. C. Cooke, author of "Rust, Smut, Mildew, and Mould," "A Plain and Easy Account of British Fungi," "Manual of Structural Botany," "Manual of Botanic Terms," etc., etc. With original figures of every species, and numerous wood-cuts. Published by Robert Hardwicke, London, 1865. 12mo. 200 pages, 11 plates, and numerous cuts.

We can heartily recommend the works of Mr. Cooke to our readers, as just the books that will interest and instruct all lovers of nature, and should be pleased to order any of them for our subscribers. — EDS.

doctor found the reptile perfectly sound, and saw it kill a large fowl instantaneously with its sting" [fangs].

On page 76, Mr. Cooke comes boldly to the question in point, and under the heading of *Does the Viper swallow its young?* gives several pages which we quote in full.

The belief has a firm hold in the minds of many, that, on the approach of danger, the young of the viper glide to their parent for protection, and that she opens her mouth, and, one by one, they pass down her throat, where they rest in security till the danger is past. To prove a negative is always a difficult task, but the effort to remove a prejudice must be even greater to be successful. Clergymen, naturalists, men of science and repute, in common with those who make no profession of learning, have combined in this belief, and to them we are indebted for many such accounts as the following: "Walking in an orchard near Tyneham House, in Dorsetshire, I came upon an old adder basking in the sun, with her young around her; she was lying on some grass that had been long cut, and had become smooth and bleached by exposure to the weather. Alarmed by my approach, I distinctly saw the young ones run down their mother's throat. At that time I had never heard of the controversy respecting the fact, otherwise I should have been more anxious to have killed the adder, to farther prove the case."* Nothing can well be more positive, clear, definite, and many would think *decisive*, than the foregoing; yet, so sceptical are some men on this subject, that they still dare to doubt whether there may not be some error in the observation. Let us advert to other witnesses, and evidence still more complete, and we do so with as earnest a desire for truth as the witnesses themselves, and to know that the debate is closed for ever.

J. H. Gurney, Esq., of Catton Hall, near Norwich, well known as an ornithologist, and especially for the splendid collection of Raptorial Birds in the Norwich Museum, which has been obtained chiefly through his instrumentality, in the year 1863 communicated to the *Zoölogist* the following instance, told to him by a person in whose accuracy he had the fullest reliance. "John Galley saw a viper at Swannington, in Norfolk, surrounded by several young ones; the parent reptile perceiving itself observed, opened its mouth, and one of the young ones immediately crept down its throat; a second followed, but after entering for about half its length, wiggled out again, as though unable to accomplish an entrance. Upon this Galley killed and opened the viper, and found in the gullet, immediately behind the jaws, the young one which he had seen enter, and close behind that a recently swallowed mouse. Galley was of opinion that the first young viper which entered was unable to pass the mouse, and that consequently there was not sufficient room for the second

* Rev. H. Bond, South Petherton, Somerset, in *Zoölogist*, p. 7278.

young one, which endeavoured unsuccessfully to follow in the wake of the first." *

To this we may add another instance corroborative, and yet more conclusive, on the faith of a clergyman with whose name and address we are furnished, and in whose testimony we have the greatest confidence. "Now, 'seeing is believing,' and I well remember having seen in my boyhood—some thirty years ago—an instance of the fact, the truth of which is doubted because resting merely on the testimony of unscientific country people. Now, I have no pretensions to science, but I vouch for the truth—above referred to—of having, in my boyhood—when out on a birds'-nesting expedition, in a southern county, with some three or four companions—come suddenly upon a viper sunning her young brood on an open grassy spot in a broad hedge-row: hedge-rows were common in those days. Immediately she saw us, she began to hiss, and away went the young, previously some feet from her, 'helter-skelter' towards their mother; rushed into her mouth—expanded to an immense width for so small a creature—and down her throat, one over the other, while you could say 'Jack Robinson.' The space where she was recreating was some twenty feet square, so that before she could beat to cover, we, boylike, being armed with sticks, had beaten her to death. This done, one of the party with his knife opened the body, and out came again the little ones, all of which we killed. I do not remember the exact number, but my impression is that it was not more than six or eight." † Another gentleman recently communicated to *Science-Gossip* the following occurrence:

"Some years since I was shooting in a wood, and came suddenly on a viper lying on a sunny bank. As soon as the viper caught sight of me, it began to hiss, and I distinctly saw several young ones, about three or four inches long, run up to the parent and vanish down its throat; and from the way in which the parent kept its mouth open, and the young ones glided into it, I should say they were accustomed to that sort of thing." ‡

We must not forget that some time since the following occurrences were narrated in the *Zoölogist*, by the editor himself, and whilst they strengthen the evidence of the viper swallowing its young, further serve to establish the fact of *viviparous* reptiles being addicted to that habit. Both these illustrations refer to the "Scaly Lizard," which, like the viper, brings forth its young alive. "My late lamented friend William Christy, jun., found a fine specimen of the common Scaly Lizard with two young ones; taking an interest in everything relating to Natural History, he put them into a small pocket vasculum to bring home, but when he next opened the vasculum the young ones had disappeared, and the belly of the parent was greatly distended; he concluded she had devoured her own offspring. At night the vasculum was laid on a table, and the lizard was therefore at rest; in the morning the young ones had re-appeared, and the mother was as lean as at first."

* *The Zoölogist*, p. 8856. † *Science-Gossip*, p. 108. ‡ *Ibid.*, p. 160.

"Mr. Henry Doubleday, of Epping, supplies the following information: 'A person whose name is English, a good observer, and one, as it were brought up in natural history under Mr. Doubleday's tuition, once happened to set his foot on a lizard in the forest, and while the lizard was thus held down by his foot, he distinctly saw three young ones run out of her mouth; struck by such a phenomenon, he killed and opened the old one, and found two other young ones which had been injured when he trod on her.' In both these instances," Mr. Newman adds, "the narrators are of that class who do know what to observe, and how to observe it; and the facts, whatever explanation they may admit, are not to be dismissed as the result of imagination or mistaken observation."*

We must confess that our own incredulity has been so staggered of late by these and similar instances, that we are by no means disposed to deny, because we cannot fully comprehend, the mystery of the process. It is admitted by some physiologists, if not by all, that there is no sound physiological reason against such an occurrence; and, until we are convinced by better arguments than have hitherto been advanced, we are bound to admit that in "our inmost hearts" there lurks a belief that the maternal viper has a knack of swallowing its young. Whether our scientific friends consider us renegade from the true faith or not, we will at least be true to ourselves.

With this feeling of Mr. Cooke's we fully sympathize, and we believe the whole matter can be put at rest by any person, who, on observing a snake in the act of swallowing its young, will think to capture and place her in a box by herself and see if the young again issue from the mouth. Should any of our readers ever obtain this much desired proof, we trust they will at once communicate it to the NATURALIST, and, if possible, send the whole family to the Academy, that the mother may be induced, if possible, to gratify us with an exhibition of her care for her offspring.

There is one other matter of interest to be decided, and that is, taking it for granted that snakes *do* swallow their young, is it a habit common to all snakes, or only to certain species? In this country this habit has been, we believe, only attributed to the several species of Rattlesnakes (*Crotalus*), and to the Water-adder (*Tropidonotus sipedon*), while in Europe it is generally attributed to the Vipers (*Pelias*). The interest in this question is farther increased

* *The Zoölogist*, p. 2269.

by the fact, that the Rattlesnake and the Vipers are ovo-viviparous; that is, their young are hatched from the eggs while still in the body of the parent, and come into the world perfectly formed. The Water-adder and the common Striped-snake are probably also ovo-viviparous, but of this we are not sure. The common snake of England, the representative of our Striped-snake, is supposed to be wholly an oviparous species. And our Striped-snake may be the same under natural circumstances, though one kept in a box gave birth to a number of living young, about the last of August; but this snake had been in confinement for a long time, and may have retained her eggs in the oviducts much longer than the natural period, owing to the want of a proper place in which to deposit them. All possible means were tried to induce this snake to take the young into her mouth but without success, though this may be accounted for by the supposition that the snake was so tame that she could not be easily frightened, or, if really an oviparous species, that it was not her habit.

We have never known that our Black-snake, Green-snake, Little Brown-snake, and other oviparous species, have ever been supposed to swallow their young. Neither have we seen any account of such an occurrence in the common snake of Europe.

There is little doubt but that many of the supposed instances of young snakes having been swallowed by the parent are owing solely to the fact that some species bring forth fully developed young; for the statement is often made by persons that they "know snakes swallow their young, for they have killed an old snake and found the young ones in her;" but, on being asked if they were sure the young snakes had ever been born, it was found that they had taken that for granted, supposing that all snakes laid eggs, and that hence the young found inside the mother must have been swallowed. This is mentioned to call attention to the care with which the examination of snakes found with

young ones should be made in order to be sure that the young were really in the alimentary canal and not in the oviducts. It is also of importance to ascertain if young snakes, after having been swallowed by the parent, ever enter the stomach or are confined to the space in the œsophagus above it. This can be discovered by cutting open the throat and following down to the stomach, which in most species is situated from about one third to one half the distance between the mouth and the termination of the alimentary canal, and can readily be determined by its thicker walls and more numerous folds on its inside, which are very marked when the stomach is not distended with food.

THE LAKES OF IOWA,—PAST AND PRESENT.

BY C. A. WHITE, M. D.

Lakes of Iowa! reiterates some New England reader, and, seeing no large bodies of water represented on the map of that Commonwealth, he really thinks ponds must be meant. Well, be it so, but the writer hereof is a western man, and in the West all collections of fresh water, whether large or small, are called lakes or lakelets. Perhaps, however, he has heard the stories of the "walled lakes" of Iowa, in which the wondrous handiwork of a departed race of men is described, consisting of walls of huge stones encircling the lakes like that of an artificial fish-pond, so raised as to prevent an overflow of water upon the adjacent low ground; sloping down to the water's edge with a pavement like a Mississippi levee; rounded and graded with earth upon the top, forming a good road upon which the Jehus of that departed race doubtless drove their elk or buffalo chariots in pursuit of pleasure or of their daily avocations; and the whole finished with a garniture of sage reflections upon the mutability of

human affairs. Such fantastic stories have been frequent in our newspapers for several years, rendering those modest little lakelets so famous that many pilgrimages have been made to their borders with the hope of finding something to aid in penetrating the mystery that shrouds the early human history of our continent.

It is such lakelets as these and their origin that will now in part engage our attention; and while showing the groundlessness of the stories referred to, we hope to present still more interesting and wonderful facts, because in the realm of Nature truth *is* stranger than fiction.

First, let us go back to their origin, for they originated from causes so definite that we are often able to comprehend them as clearly as if we saw them in operation; and the time of their formation in relation to other geological changes is as accurately determined as that of any other. Not only have the lakes had a definite origin, but, as we shall presently see, some of them have also had an end, and we know they once existed only by means of the records they have left in the earth they once covered. Hence the addendum to the above title,—past and present.

Lakes have doubtless existed upon the earth's surface in every geological age; but those of which we are speaking had their origin at a period really very remote when considered in relation to the historic era, but *very* recent when compared with the geological ages which preceded it.

At the close of the Glacial epoch the ice disappeared from the temperate zone, the present condition of the climate was established, and the continent assumed very nearly its present dimensions and form. The northern part of the Great Valley—it is to this region to which more especial reference is made—was not then marked by strong topographical features, for it was traversed by no ranges of mountains, nor by any rivers or streams. Shallow depressions only, which were filled with water from the rains and the melting ice, marked the surface. These were the primitive lakelets, and

existed before any definite streams were formed. Where the depressions were longitudinal, or connected in chains, they gave initial direction to the courses of the streams into which the surface-waters were gathered and carried away to the sea. These are the streams of to-day, and their ceaseless flow, aided by the rains and frosts of the unnumbered years that have passed since then, have worn their own channels down, not only through the incoherent drift, but often also through solid stratified rocks, the edges of which we see protruding from their valley slopes. Thus all the valleys of this region are valleys of erosion, and it is meteorological erosion alone that has given it its most prominent physical features.

As one stands upon the broad level prairies of Southern Iowa, and sweeps the well-defined ocean-like horizon with his level, he finds the bubble everywhere resting upon the cross-wire except where the distant dark line of forest foliage reveals the presence of a stream. Approaching this, the surface becomes undulating like the smooth rolling of a sea; but looking closely he will see that every depression leads into a still deeper one until the upper branches of the streams are reached, the surfaces of which are often more than one hundred and fifty feet below the prairie level from which he started; and the surfaces of the larger streams are sometimes a hundred feet deeper still. The higher prairie-surface of to-day is the same surface which was left by the retiring waters at the close of the Glacial epoch, and the time which has passed since then—that during which the valleys were formed—is called by geologists the Terrace epoch, because the oscillations of the streams from side to side of their valleys in the process of their erosion have left frequent terraces of material which successively constituted "flats" or "bottoms" bordering the streams, but which are now far above the reach of their highest floods. The Terrace epoch verges upon the present time, because the same streams still flow, and earthy matter is still carried by them to the sea, as rap-

idly perhaps as it ever was, although only occasionally sufficient in amount to muddy the water. Thus it will be seen how slowly the mightiest operations of Nature are performed; for this most recent of the geological changes has doubtless required a length of time so great that the human mind is incapable of comprehending it.

In Northern Iowa the prairie horizons are not so clearly defined as they are farther to the southward, and it was doubtless so at the beginning. The drift also contains more gravel and bowlders there, from the fact that nearly all of those materials originating still farther to the northward, their abundance diminished with the diminishing force of the glaciers to the southward. Numerous irregular rounded elevations or knobs mark the surface, between which are corresponding depressions; not produced however by erosion since the drift was deposited, as the river valleys were, but are, like the knobs, inequalities left by the glaciers.

Some of these depressions have become drained; some of them are still occupied by the lakelets, and some by peat marshes. Streams are numerous in Southern Iowa, and their valleys deep. Consequently the country is so well drained that all trace of the primitive lakelets is usually obliterated. But many of those streams have their rise in Northern Iowa, and many of those lakelets still exist there, because no accumulation of water beyond has sent a current across them to cut a channel for their outlet. Lake basins are sometimes hollowed very deeply into the earth, showing bold exposures of stratified or unstratified rocks upon their shores. But the lakelets of which we are speaking, had their origin in shallow depressions left in the surface of the drift alone at the close of the Glacial epoch. By the action of subsequent causes they, in certain regions, became "walled lakes;" for a majority of them are as worthy of that designation as those are of which the fanciful stories have been told. Nor are lakes of that character confined to Iowa alone, but are known also in Minnesota, Wisconsin, Michigan, and even in Connecti-

cut; yet all except two, one in Wright county, and the other in Sac county, Iowa, seem never to have been favored with the visits of an imaginative writer to tell fanciful stories of their associated remains of human handiwork.

It seemed necessary to make the foregoing statement of facts, and the geological principles which they involve, before attempting a description of the lakelets themselves, that such a description might thus be rendered more intelligible, and which is here given as the result of long-continued observation of sixteen such lakelets in Northern Iowa, including the two which have become noted as walled lakes.

They usually occupy an open prairie region. Sometimes small groves are near them, but trees are often entirely wanting, especially since the settlers mercilessly destroy them for fuel. They are from one to five miles across, but always very shallow, because the undulations within which they rest are very gentle. None of them are more than fifteen feet deep, and the majority are so shallow that they permit a luxuriant growth of wild rice and other aquatic plants from their bottoms over the whole, or a large part of their areas, among which water-fowl find shelter and abundant food, but which renders them rather uninteresting features of the landscape.

A true description of the so-called walls, but which we shall term embankments, will be best understood if given in connection with a description of their origin. When a pile of sand, obtained from the river shore, has been left by the workmen for a long time exposed to the washings of the rains, the gravel which it contains, and which at first is hardly visible, becomes in some cases even more conspicuous than the sand itself, because a part of the latter has been wasted, while the gravel remains. Thus it has been upon an extended scale with the drift, which, as before stated, is composed of bowlders, gravel, sand, clay, and soil, although little except the latter is usually seen upon the prairie surfaces. Sometimes the drift is more than a hundred feet

thick, and all the bowlders contained in the whole mass which has been swept out to form the valleys have gradually rolled down upon their slopes, and many of them into the streams. For this reason we usually find them more numerous upon surfaces that have suffered erosion than anywhere else. Again; the ceaseless dashing of a lakelet's waves stir up the finer material beneath its waters, to be carried away in the form of muddy water at the times of its overflow, leaving the bowlders and gravel strewn upon its bed; while they may not be seen at all upon the prairie surfaces around them.

This latter fact being misunderstood has led to the supposition, that, being absent upon those surfaces, they had been gathered up by human hands and carried to the shores to build the "walls" of; while the truth is, the embankments, as well as the presence of the materials of which they are composed, are due to natural causes alone, and their origin is wholly referrible to the periodic action of ice, aided in some degree by the force of the waves.

The water in the lakelets is usually very low in late autumn, and when winter comes it is sometimes frozen nearly to the bottom in their deepest parts, so that occasionally all the fish are killed by this means. The ice, of course, freezes fast to the bowlders as well as to whatever else may be within its reach, and the expansive power of from one to five miles of freezing water is exerted upon them in a direction from the centre towards the shores,—a power much more than sufficient to move the largest bowlders upon those gentle slopes.

The embankments are from two to six feet high, and from two to twenty feet across the top, and always separate a low piece of ground from the lake; because where the original shore is a little abrupt, and higher than the high-water level, no embankment is formed, but the bowlders are merely thrust against the shore with such force as to render it steep, and often thickly studded with them.

Meeting no such obstruction on a marshy side, the material thrust out accumulates just where the expansive force of the ice is spent. This process repeated year after year, from age to age, has cleared the bottom of the lakelets of their bowlders and other materials, and piled them up in circular ridges upon their shores; and these are the "walls" which have excited so much wonder. It has been observed that the embankments are heaviest on the sides opposite the prevailing winds. This may be accounted for, at least in part, by the fact that the ice being burdened with the material to which it has frozen fast, would thus be floated against those shores when the spring floods had raised the water of the lakes; and in part also by the farther fact that the dashing of the waves would be most constant against those shores.

Thus it will be seen that whatever was originally upon the bottom, whether bowlders, gravel, sand, or mud, has been carried to the shore, and we find the embankments composed of all these materials arranged in perfectly natural disorder. If bowlders were numerous, the embankment is largely composed of them. If sand prevailed, a broadly rounded embankment is formed, just such as we should expect from such material; and where a peat marsh extends out into the land, an embankment of turf is thrown up at the water's edge, which, being supported by living rootlets, is frequently high and very narrow. The latter are somewhat numerous, and are often called beaver-dams; but this is also a misconception, because beavers never attempt to dam still waters. They dam running streams to obtain ponds of still water. Thus we see that the same natural force placed the bowlders in the embankments that brought them down from their northern homes, namely, the expansive power of ice.

If its crust should remain perfectly stable long enough, the earth would become nearly a perfect sphere by the disintegration of its exposed substance, and the levelling force of gravitation. It is true that its inequalities of surface are

now very insignificant compared with the vastness of its bulk; but, in such a case, there would be no mountains, no islands, no continents. All would be an endless and shoreless sea. The erosion of the river valleys, and the consequent drainage of a majority of the primitive lakelets, may be regarded as the first steps in this levelling process, after the glaciers had ceased from the Great Valley; for its post-glacial geology seems to warrant no subdivision into epochs such as are made for other regions. Therefore the whole is here referred to the Terrace epoch. Long before this levelling process can approach completion, other elevations and depressions will be formed upon the changing surface. See, then, how small a part of such a result has been accomplished even by the erosion of the valleys of the great Mississippi and its branches. A part of the primitive lakelets, and a part of the original surface of the drift still remain almost unchanged since their formation. The prairies have still their ocean-like surfaces, and the greatest change the lakelets have undergone in that immense lapse of time is the formation of their insignificant embankments, if aught in nature may be called insignificant. Let us look a little to what has been accomplished by erosion in the Great Valley* during the Terrace epoch as before defined.

Along the courses of what are now the Mississippi and Missouri Rivers, large depressions formerly existed which formed lake-like expansions of those rivers. Thus after the Mississippi had made for itself a definite valley, but before it had cut its channel down to its present level through the rocky obstruction at the Keokuk rapids, that portion of it which borders a large part of the eastern side of Iowa was little else than a lake which averaged about five miles wide, and filled the space between what are now the bluffs that border each side of its broad flat valley.

*It will be observed that the word *valley* is used with two separate significations; one applied to the hydrographic basin drained by a certain principal stream and its tributaries, and the other to the depression occupied by any particular stream, and which its own waters have cut out of the general surface.

This is proven by the existence there of terraces composed of very fine sedimentary material such as could have been deposited only in comparatively still waters, and also by the existence in that sediment of shells which inhabit still waters only, — the same species which now inhabit fresh-water lakes. River shells, such as now exist in the river, are found on the sides of the bluffs near the rapids at a height of seventy feet above the present high-water mark; and since such beds of shells exist only at low-water mark when alive, upward of eighty feet must be estimated as the height of the river above its present level at the time they lived. It will be observed that river, and not lacustrine shells are found near the rapids. This is accounted for by the fact that the obstruction which caused them, being a flinty formation, and not so easily disintegrated as the other rocks are over which the river runs, has existed as such from its earliest history. Consequently the water there always had a considerable current, while farther to the northward there was too little current to produce a congenial habitat for those shells. The estimated eighty feet is doubtless only a part of the actual height from which the erosion of the Mississippi Valley has reached, because it now averages about two hundred feet deep from the general prairie surface. Thus we see that when that lake-like expansion existed in the Mississippi River, its valley had already been eroded to a considerable depth, and the Terrace epoch was well advanced. But on the other side of the State we have proof of the existence, in the early part of that epoch, of a lake which was larger and deeper than Lake Erie. This proof consists principally in the presence there of a peculiar lacustrine deposit extending at least from the Big Sioux to the mouth of the Kansas River, and from twenty to thirty miles on each side of the Missouri River, through which the latter has cut its present valley, in some places to a depth of more than two hundred feet before it reached the drift which was deposited there during the Glacial epoch. That mate-

rial is known to have been deposited in fresh water, because only fresh-water shells are found in it, and they are found in it from top to bottom. It is known to have been deposited in still water, because the same kinds of shells are now living in still water only, and because the whole deposit is a fine homogeneous material without sand, gravel, bowlders, or any thing else, except what would have been deposited in a lake of *muddy* water.

It has been claimed by a few geologists that at the close of the Glacial epoch a shallow fresh-water lake occupied the whole hydrographic basin of the Mississippi, and that the fine soil and subsoil of the prairies and other lands of the whole region, as well as the peculiar deposit just referred to, are identical in their formation, and had their origin in one and the same broad lake. Upon this hypothesis some have accounted for the origin of the prairies and for the absence of trees upon them; but the fact is, prairies exist upon both these deposits, and it would require direct effort to keep all kinds of indigenous trees from encroaching upon the prairies if there were no annual fires.

It is not improbable that such a wide-spread sheet of fresh water did exist at that time, and that a large part of the sedimentary material that composes our soil and subsoil had such an origin. But that is widely different in physical characters from the deposit under discussion, which evidently had a different, as well as a subsequent origin. These circumstances seem to leave no room to doubt that a well-defined lake existed there after the continent had in great part become dry land, but before the great rivers had cut their valleys down to any considerable depth. The lake, although so large and deep, was doubtless filled with sediment to the general prairie level within a comparatively short time after the glaciers ceased, just as the sediment of the same river which then flowed into and from it, now speedily fills the reservoirs of the St. Louis Water-works, so that they must often be reëxcavated. Just as the same

river would now fill with the same kind of sediment any depression, however large, if such existed in its course.

The great northern lakes are not thus filled, because their tributary streams are pure; and their streams are pure because they flow over geological formations that are not easily disintegrated; while the main tributary of that ancient lake, the Missouri River, is even now one of the muddiest streams on the globe. In the earlier portion of the Terrace epoch it was, if possible, more so; for then as now, it gathered up its sediment from that broad region occupied by the friable rocks of the Tertiary and Mesozoic ages, stretching far away toward the Rocky Mountains, at that time strewn with the grindings fresh from those "mills of the gods"—the glaciers.

The formation of the basin in which the lake rested is known to have taken place during the Glacial epoch, because the drift, with its striated bowlders, now covers its bottom beneath the lacustrine deposit, and because the cutting out of the river valley has exposed, in a number of places, the stratified rocks which the drift rests upon, whose surfaces were scored and striated by the moving glaciers of that epoch. It is known that the filling of the lake with sediment occurred in the early part of the Terrace epoch, because it was filled up even with the prairie surfaces, which would not have been done if the Missouri River had first eroded its valley to any considerable depth below the lake. We know that the lake was so far filled with sediment before it was drained, that it was little else than a marsh, because the top of that deposit of sediment is now nearly even with the higher prairie surfaces, and because the river bluffs which it forms are as high as those formed of the usual materials, —the drift and stratified rocks.

The physical characters of this lacustrine deposit are so peculiar, that they attract the attention of every person who becomes acquainted with it, although a stranger might pass over the formation without observing more than its peculiar outline of bluffs. It is perfectly uniform in character and

color from top to bottom, and a hundred miles of distance show no more difference than a hundred feet. It is of a slightly yellowish ash-color, except where rendered darker by decaying vegetation, very fine, not sandy, and yet not adhesive. At the surface it makes excellent soil, and is just as fertile if obtained at a depth of two hundred feet. It is easily excavated by the spade alone, and yet it remains so unchangeable by the atmosphere and frost, that wells dug in it require to be walled only to a point just above the water-line, while the remainder stands so securely without support that the spade-marks remain upon it for many years. Road embankments upon the sides of excavations stand like a wall, showing the names of ambitious carvers long after an ordinary bank of earth would have disappeared. As that part of the valley of the Missouri River below the lake was deepened during the Terrace epoch by the natural process of erosion, the peculiar material which its own waters had previously deposited offered little obstruction to that process, but was readily swept out again as muddy water, and sent on its way to the sea. Thus no more of it was cut out than served to form the valley, which is from four to twelve miles wide, while the larger part remained, forming the bluffs, and extending far inland from the river. The tributary streams which at first emptied into the lake, now traverse its ancient bed of sediment to the river, and have cut down their own valleys to meet it. The sides of these valleys where they traverse that sedimentary deposit are steep like the river-bluffs, and the streams being smaller, their valleys are narrow and very deep. This is particularly true of all those Iowa streams that empty into the Missouri River above Council Bluffs, and they thus present great obstacles to the construction of lines of railway directly east and west through that State. For this reason, and for the purpose of connecting with the great Pacific Railway at Omaha, the more northern of those lines are diverging to the southward down the valleys of the streams, instead of crossing them, so

that passengers will pass dry-shod through the bed of that ancient lake, although many fathoms beneath the level at which its waters used to rest.

The peculiar outline of the bluffs along the Missouri River valley is one of the most interesting features of this remarkable deposit. As one views them in the distance, and in their nakedness, for they are often entirely destitute of trees, towering up from the level bottom-land, sometimes more than two hundred feet in height, so steep in some places that a man cannot climb them, he can hardly rid himself of the idea that they are supported by a frame-work of rocks as other bluffs are. Yet not a rock or pebble of any kind or size exists above their base of drift, except a few calcareous concretions which were formed from the limy water that now percolates through the whole mass. The form and arrangement of their numerous rounded prominences sometimes present views of impressive beauty as they stretch away in the distance, or form bold curves in the line of hills.

A few miles below the city of Council Bluffs, they present a full crescentic front to the westward, with the broad Missouri bottom stretching miles away from their base to the river. Their only vegetation here is a covering of wild grasses, and as the mound-like peaks and rounded ridges jut above each other, or diverge in various directions while they recede backwards and upwards to the higher lands, the setting sun throws strange and weird shadows across them, producing a scene quite in keeping with that wonderful history of the past of which they form a part.

REVIEWS.

THE AMERICAN BEAVER AND HIS WORKS.*—Mr. Morgan has, in this elaborate work, given us a thoroughly accurate and most entertaining account of an animal whose instincts and habits and economical value have attracted universal attention. The work is illustrated by lithographic plates from photographs of beaver-dams and their surroundings, taken with great pains in the wilderness on the south-west shore of Lake Superior. The frontispiece represents the beaver, and if actually taken from life is drawn in a remarkably ungraceful attitude, that of listening, which shows what a stiff and clumsy animal it must be on land.

A railroad to the iron region opened up "a beaver district more remarkable, perhaps, than any other of equal extent to be found in any part of North America," offering a rare opportunity for a careful study of this creature.

An anatomical chapter by Dr. W. W. Ely, and a geological account precedes the history of beaver-dams, lodges, burrows, canals, meadows, trails, and their means of subsistence, which are followed by chapters on the mode of trapping the beaver, and its psychology.

Besides the common brown beaver, there occasionally occur a black form and albinos. "In form the beaver is short between the fore and hind legs, head heavy and clumsy, and his motions are slow and awkward. He walks with a waddling gait, with his back slightly arched, with his body barely clearing the ground, and his tail dragging upon it;" in the water, however, it is very graceful. It swims chiefly by the webbed hind feet. The fore feet are very small, and, "as they are capable of a very considerable rotary movement, he is able to hold sticks and limbs of trees, and to handle them with great dexterity while cutting them, and also to carry mud and stones." As the beaver lives more often in burrows, his paws are armed with large powerful claws, of which there is an extra one on the second toe of each hind foot, which is peculiar to this animal. It uses its tail to assist variously in swimming and diving, to give an alarm by striking the surface of the water, giving a report that can be heard half a mile; and also as a trowel to "pack and compress mud and earth while constructing a lodge or dam, which he effects by heavy and repeated down strokes." "They pair, and, with their offspring, live in the family relation until the latter attain maturity, when they are forced to leave the parent lodge." But they do not live in villages, though two or more such families inhabit the same pond, and together keep the dam in proper repair. The beaver lives for twelve or fifteen years; carries its young from three to four months, bringing them forth usually in May, "and from two to five and sometimes six at a time."

* The American Beaver and his Works. By Lewis H. Morgan. Philadelphia, 1868, 8vo, pp. xi, 330. With plates and illustrations.

The author states that even the largest dams are the work of a single family carried on year after year, being "maintained for centuries" by constant repairs. Grass Lake dam, the largest one, perhaps, in North America, is fully described. It was two hundred and sixty feet and ten inches in length, and six feet and two inches in vertical height at the centre of the great curve in the middle of the stream, where it slopes thirteen feet on the lower face. It has been supposed to be an evidence of high intelligence that the beaver built its dam so as to curve up stream where the pressure of the water is the greatest, but the author candidly questions whether these curves are the result of accident or design.

Beaver-dams are usually sinuous, but curve either up or down stream, "a downward curve being much more common than the reverse in the large streams. The dam generally curves down in those streams that discharge the largest volume of water, when also the dams are shorter and lower than those on the smaller brooks."

The great dam on Grass Lake, so fully described, "contains upwards of seven thousand cubic feet of solid materials." This dam is also supplemented by an upper and a lower dam to break the force of the stream in freshets; the lower one setting the water back to the depth of twelve or fifteen inches in the great curve. Such structures are remarkable instances of prevision and engineering skill, reminding us of the intelligence shown by the Agricultural Ant of Texas, which, according to Dr. Lincecum, erects mounds on the "pavement" of its formicary in dry weather, in anticipation of the rainy season!

In excavating this artificial canal for transporting their wood by water to their lodges, beavers evince the most intelligence and "a complicated and extended process of reasoning," though the work is simpler than building a dam, and, like the latter, requires many years of continuous labor.

Like all close and patient observers of the habits of animals, the author believes that animals have a reason different only in degree from that of man. "When a beaver stands for a moment and looks upon his work, evidently to see whether it is right, and whether anything else is needed, he shows himself capable of holding his thoughts before his beaver mind; in other words, he is conscious of his own mental processes." "A canal is not absolutely necessary to beavers any more than such a work is to mankind; but it comes to both alike, as the result of progress in knowledge. A beaver canal could only be conceived by a lengthy and even complicated process of reasoning." In Missouri, where the river banks are steep the beaver constructs no canal, but "slides" which are unknown and not necessary in the Lake Superior region. "Contrary to the common opinion is there not some evidence of a progress in knowledge to be found in the beaver-canal and the beaver-slide? There was a time, undoubtedly, when the canal first came into use; and a time, consequently, when it was entirely unknown." The author hence argues a progression in knowledge, and hence improvement "from a lower to a higher

artificial state of life;" and the possession of a "free intelligence," far above the operation of a blind instinct, by which an animal is, according to Descartes' theory, a "mere machine." And yet the author concedes that the beaver is lower in intelligence than the carnivorous animals, the dog, fox, cats, etc. He ascribes memory, imagination, will, appetites, and passions and an intellect to dumb animals, and cites the case of Dr. Kane's lunatic dog as an evidence that these animals have a *mind to lose*.

Transactions of the Chicago Academy.*—We congratulate the Chicago Academy that this splendid volume, after vexatious delays caused by two fires, has at length appeared. It contains an article on Western Palæontology, by Professor J. H. McChesney, and Descriptions of Sub-carboniferous and Carboniferous Fossils, collected in the Iowa Geological Survey, by Dr. C. A. White and Mr. O. H. St. John. Dr. I. A. Lapham contributes a paper on the Climate of the Country bordering on the Great Lakes. Mr. F. B. Meek has an article on the Geology of the Valley of the McKenzie River, from notes and fossils collected by the late Robert Kennicott; and Dr. William Stimpson contributes Illustrations of North American Birds in the Museum of the Academy, illustrated with beautiful colored plates, presented to the Academy by the liberality of several of its members and patrons. The Academy also publishes its octavo "Proceedings," and recently dedicated its new and spacious Museum. Science is carefully fostered in the West; the railroad companies provide the officers of the Academy with free passes and free freightage over their roads, and liberally extend other facilities and courtesies to naturalists engaged in scientific explorations.

Popular Science Review, *January* (London).—M. Trécul has discovered the existence of minute vegetable organisms (*Amylobacteria*) within the starch-cells of *Helianthus tuberosus*, the Jerusalem artichoke. This has by him been regarded as a decided proof of the spontaneous generation of plants. The Review objects that vegetable forms of the lowest type may enter the tissues of animals. There is no more wonder in the fact of a Cholera-fungus in the blood of man than in a Amylobacterium in the starch-cell of a Helianthus tuberosus.—Professor Rolleston believes that the domestic cat of classical times was probably a Marten.—Herr. C. Claus, of Marburg, has published a paper to prove that the male of *Psyche helix*, a small moth allied to the Silk-worm moth exists. Our readers are aware that the case of *P. helix* was one of the "leading cases" in the history of Parthenogenesis, or development from asexual animals. —M. Donné, who has so long and ably supported the heterodox theory of spontaneous generation, has cried *peccavi*. He admitted that his latest researches, so far from supporting heterogeny, convince him of the accuracy of the views of his old opponent, M. Pasteur.

* Transactions of the Chicago Academy of Sciences. Vol. I, Part I. Royal 8vo. Chicago, 1867. With a map and eighteen lithographic plates and numerous wood-cuts. Price, $5.00 a part. (This merely covers the cost of publishing.)

QUARTERLY JOURNAL OF SCIENCE, *January* (London). — Signor Cocchi announces the discovery of a human skull in the lower beds of the Lower Post-pliocene strata in Italy. This lower portion consists of lacustrine clays of great thickness, with layers of peat towards its superior margin; it contains bones of the Mammoth (*Elephas primigenius*), *Cervus euryceros*, *Bison priscus*, and a species (probably new) of the Horse, *Equus;* it has also yielded stone implements and a human cranium, the latter from the plain of the Aretino. Whether this deposit be termed Lower Post-pliocene, or anything else, there seems little room for doubt that the skull was imbedded contemporaneously with the remains of the Mammoth, etc., and that Man lived in Italy contemporaneously with those animals.— The term *Gregarinæ* applied to the Chignon Fungus (see NATURALIST, vol. 1, p. 379), is most inappropriate, as is admitted both by Drs. FOX and Beigel. It is the *Pleurococcus Beigelii*. The *Gregarinæ* are indubitably animals, and are internal parasites.

NATURAL HISTORY MISCELLANY.

BOTANY.

VITALITY OF SEEDS. — Dr. Gray, in his "How Plants Grow," says, "The stories of seeds growing, which have been preserved for two or more thousand years with Egyptian mummies, are not to be believed." M. Figuier, in his work on "The Vegetable World," also cautions his readers against accepting certain statements of earlier writers to the effect that various seeds have been known to germinate after having been deposited in Roman and Celtic tombs nearly two thousand years. He then says, "We must not forget to speak of those wonderful seeds of wheat found in the tombs of ancient Egypt. It is now acknowledged that in this affair some one must have abused the confidence and credulity of the travellers. A variety of wheat called Mummy-wheat is common, it is true, among farmers; but no authentic fact justifies its name." From a paper recently drawn up by the Rev. Dr. Marks, of Meadville, Pa., at the request of a member of "The Natural History Society of the Meadville Theological School," I condense the following statement, using as far as possible the language of the original paper.

When Dr. Marks was in Thebes, in the winter of 1856, the Arabs were dragging forth from the mummy-pits great numbers of mummies. He saw them tear off the linen wrappings, in the folds of which were many pieces of papyrus, covered with Coptic characters. Very often in the mummies' hands were found grains of wheat, dura, flax, and the nut of the palm-tree. From the hand of one was thrown out the seed-cup of a

rose, which he picked up and brought away with him. This he subsequently gave, while residing at Quincy, Ill., to Mrs. Gov. Wood. On opening the seed-cup, she found several seeds, which she planted in a flower-pot, in her green-house. In the course of three weeks, two of these germinated, and, the next year, blossomed, producing a pink single rose, unlike any American variety with which they were acquainted. The estimated age of the mummy, from which the seed-cup was taken, was twenty-five hundred years.

Dr. Marks has in his possession some seeds of the *dura* (which he supposes to be the *corn* spoken of in the Book of Genesis), obtained by him from Egyptian mummies; but he has never tested their vitality. He testifies, however, to the fact of some dura seeds having been found in the hand of a mummy unrolled at Springfield, Ill., a few years since, which were planted by the Rev. Albert Hale, pastor of the First Presbyterian Church in that city, and which produced the same year several full-grown stalks, as large as Indian corn, and covered over with clusters of fruit which matured.

As throwing some light on the causes of this wonderful preservation of vitality, Dr. Marks states that the mummy-pits are perfectly dry, being situated from three to five hundred feet above the level of the Nile, and cut out of the rock of the mountain, which is a soft calcareous limestone. The pits are never either cold or damp. — Geo. L. Cary.

[If these seeds had been only thirty or forty years old, their prompt germination, although unlikely (for those who are in the habit of trying old seeds know how difficult it is to make any old seeds germinate), would be promptly believed upon this evidence. But marvels are to be credited only upon more rigid scrutiny. Scientific men will think it far more probable that some mistake has occurred in respect to the seeds, or deception by the Arabs, than that seeds 2,500 old actually grew. — A. G.]

Bees vs. Fruit. — It is high time, we may add, that the *Peabody Academy of Science* were in full operation in Essex County, when one of its towns votes to "abate the nuisance" of bees, on the ground that they are injurious to fruit!

As to the nectar of the red clover being out of the reach of the honey-bee, it may be asked whether this be the case with the second crop, in which the flowers are generally rather smaller. The much better seeding of the second crop of red clover is thought to be owing to the greater abundance of bumble-bees in the latter part of summer. — A. Gray.

The Sun-dew, a Fly-trap. — Mr. Millington has well described, in the April number, the phenomenon of fly-catching by the Sun-dew, and his wholly original observations show that he has perfectly comprehended these curious facts. That the *Drosera* catches flies in this way was, however, known to botanists and recorded in botanical works more than half a century ago. But the statement attracted little attention, and finally nearly died out of the books. It was re-discovered by Mr. Darwin, in England,

perhaps a dozen years ago, but I know not whether his observations are published, except by a brief allusion in the Gardeners' Chronicle. He found, as did Mr. Millington, that while the bristles will close upon a bit of raw meat, they are not sensitive to an inorganic body; yet that they are so to a bit of carbonate of ammonia. Mr. Darwin followed up this subject by some very interesting observations and experiments upon the Venus Fly-trap, *Dionæa*, which, with some recent ones made in this country, may soon be published. — A. GRAY.

FLOWERING OF HEPATICA TRILOBA. — March 12th, I found three *Hepaticas* in blossom, and on March 29th, I gathered quite a handful. — J. H. SEARS, *Danvers, Mass.*

ZOÖLOGY.

INSTANCES OF ALBINISM AMONG OUR BIRDS. — In a recent number of the NATURALIST, a correspondent mentions a "Singular Variety" of the Field Sparrow (*Spizella pusilla*). His specimen is an example of the partial albinism which is, perhaps, not so rare among birds as it is generally supposed to be. When we remember what an extremely small percentage of individuals of any species comes under observation, the wonder rather is, that so many albinos are found. In the course of a few seasons' collecting, I have met with the following instances of albinism, partial or complete.

Field Sparrow (*Spizella pusilla*). A specimen shot in the fall has the wings and tail mostly white, and all the upper parts patched here and there with white.

Western Snow-bird (*Junco Oregonus*). A specimen shot at Fort Whipple, Arizona, Dec. 12, 1864, has a large, somewhat circular, pure white spot on the throat, distinctly defined against the surrounding dark colors. The plumage is otherwise perfectly normal.

Blue bird (*Sialia sialis*). A curious specimen, with a triangular white spot on the back of the neck; otherwise perfectly normal in plumage. I have seen this species entirely snow-white, with (probably) pink eyes, and flesh-colored bill and feet.

Robin (*Turdus migratorius*). With a large white spot on each side of the head, formed by the enlargement and coalescence of the white spots which occur normally about the eyes. The robin also occurs in snow-white plumage.

Bank Swallow (*Cotyle riparia*). With the upper parts delicate pale silvery gray; the under parts pure white, as usual. This is the only instance I have met with of albinism in this bird.

Blue Yellow-backed Warbler (*Parula Americana*). This is, in some respects, the most curious example of partial albinism I have ever seen, occurring in a family of birds little liable to this abnormity. The entire plumage is mottled and patched with white, the natural colors appearing in the spaces between the white areas.

Yellow-rumped Warbler (*Dendroeca coronata*). All the slate and blackish colors are replaced by dull silvery gray.

The common Quail (*Ortyx Virginiana*) is occasionally found with all the tints so light, dull, and faded as to fairly be considered albinotic. There is a specimen in this condition in the Smithsonian Institution. Crows and Blackbirds seem, to judge from the frequency of the occurrence of albinos, to be particularly liable to this aberration in color. The expression, "a white blackbird" is hardly so paradoxical as it might seem; and indicates as well established a fact as that "blackberries are red when they are green."

The Black Guillemot (*Uria grylle*), and the Sea-dove (*Mergulus alle*), are both very obnoxious to albinism; and, in fact, each has been described in this condition as a distinct species. But the albinotic condition of the Black Guillemot must not be confounded with its normal winter plumage, which is nearly white. The albino has no black whatever about it; the eyes are pink, and the bill and feet flesh-colored.

The question of albinism among the large Gulls of the genus *Larus*, possesses unusual interest. The study of this condition among these birds is more than a matter of simple curiosity; having important bearing upon the validity of at least one of our accredited American species (*L. Hutchinisii* Richardson). Numerous authors speak of a "pure-white Gull," and several specific names have been based upon such a condition of plumage. The bird referred to is about the size of, or rather smaller than the Burgomaster (*L. glaucus*). If it is really a valid species, it would constitute the only known exception to the rule, that all the true *Lari* have the back and wings darker than the under parts.

The Philadelphia Academy has a fine albino Giant Petrel (*Ossifraga gigantea*). This is pure white, patched here and there with isolated blackish feathers. In the Smithsonian Institution there is a perfect albino Red-throated Diver (*Colymbus septentrionalis*). It is nearly snow-white, with pink eyes and flesh-colored bill and feet.

The opposite of albinism — *Melanism* — is an extremely rare condition. At this moment I can recall but a single instance of its occurrence. This is the Black Guillemot, which is occasionally found without a trace of white upon or under the wings. In this state it has been described as a distinct species (*Uria "unicolor"*). — Dr. Elliott Coues, U. S. A.

Return of the Birds. — The following birds, which left for their southern quarters about November last, returned to the vicinity of Danvers, Mass., in numbers, at the dates given:

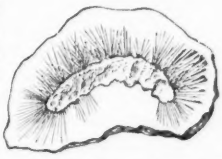
Wild Geese passed to the northward February 26; Black-ducks, Robbins, Red-shouldered Hawks, Blue-jays arrived March 2; Cedar-birds, Gold-finches, Lesser Red-poll Linnets, March 4; Star-breasted Larks, Woodcocks, March 8; Golden-winged Woodpeckers, Purple Finches, Bluebirds, March 12; Red-winged Blackbirds, Swamp Sparrows, Yellow-winged Sparrows, March 15; Common Pewees, Marsh Hawks, March 25; Wood-ducks, Crow Blackbirds, March 26; White-bellied Swallows (four specimens), March 27. — J. H. Sears, *Danvers*.

GEOLOGY.

Fossil Insects.—In Mr. Scudder's paper in the February number, allusion was made to a fossil lace-winged insect which appeared to have a stridulating organ at the base of the wing, like that of crickets and some grasshoppers. We give here a figure (Fig. 1) of this wing, called by Mr. Scudder *Xenoneura antiquorum*. We have also copied the figure (Fig. 2) of the so-called caterpillar (*Palæocampa anthrax*), which Messrs. Meek and Worthen have described in the Report of the Geology of Illinois. Mr. Scudder believes it to be a worm, although, in many external features, it strongly resembles the woolly caterpillars. Messrs. Meek and Worthen, who describe and figure this fossil in the Report of the Geological Survey of Illinois, vol. 2, Palæontology, 1866, state that "the specimen is not in a condition to show the head or feet; yet we are strongly inclined to believe from its form, and peculiar regularly arranged bundles of hairs, that it is a *Caterpillar*. If we are right in this suggestion, its discovery is certainly an interesting one, as it would present an evidence of the existence of *Lepidopterous* Insects, at a much earlier period in our world's history than has hitherto been suspected." It was found near the base of the Coal-measures, Morris, Illinois.

Fig. 1.

Fig. 2.

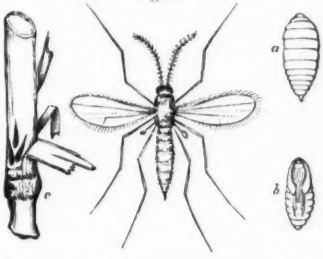


ENTOMOLOGICAL CALENDAR.

It should be remembered, that, unless otherwise stated, the dates given in the Calendars apply to the Northern States, especially New England, the same species appearing earlier southward.

Among the injurious hymenoptera, which abound late in this month, is the Rose Saw-fly (*Selandria rosæ*) and *S. cerasi*. The eggs are then laid, and the last of June, or early in July, the slug-like larvæ mature, and the perfect insects fly in July. Various Gall-flies now lay their eggs in the buds, leaves, and stems of oaks, maples, raspberries, and blueberry and other plants.

Fig. 1.



Dipterous Gall-flies are now laying their eggs in cereals. The Hessian-fly (*Cecidomyia destructor*, Fig. 1) has two broods, the fly appearing both in spring and autumn. The fly lays

twenty or thirty eggs in a crease in the leaf of the young plant. In about four days, in warm weather, they hatch, and the pale-red larvæ "crawl down the leaf, working their way in between it and the main stalk, passing downward till they come to a joint, just above which they remain, a little below the surface of the ground, with the head towards the root of the plant. Here they imbibe the sap by suction alone, and, by the simple pressure of their bodies, become imbedded in the side of the stem. Two or three larvæ thus imbedded serve to weaken the plant, and cause it to wither and die. The second brood of larvæ remains through the winter in the flax-seed, or *puparium*. By turning the stubble with the plough in the autumn and early spring, its puparium may be destroyed, and thus its ravages may be checked. (Fig. 1 represents the female, which is about one-fourth as large as a mosquito: *a*, the larva; *b*, the pupa; and *c* represents the joint near the ground where the maggots live.) The same may be said of the Wheat-midge (*Cecidomyia tritici*), which attacks the wheat in the ear, and which transforms an inch deep beneath the surface.

Among the butterflies which appear this month are the Turnip-butterfly (*Pontia oleracea*), which lays its eggs the last of the month. The eggs hatch in a week or ten days, and in about two weeks the larva changes to a chrysalis. *Thanaos juvenalis* and *T. Brizo* fly late in May. The caterpillars live on the pea and other papilionaceous plants. *Thecla Auburniana*, *T. Niphon*, and other species fly in dry sunny fields, some in April. *Argynnis Myrina* flies from the last of May through June, and a second brood appears in August and September. *Vanessa J-album* and *V. interrogationis* appear in May, and again in August and September. The caterpillars of the latter species live on the elm, lime, and hop-vine. *Grapta comma* also feeds on the hop. *Alypia* 8-*maculata* flies at this time, and in August its larva feeds on the grape. *Sphinx gordius*, *S. Carolina*, and other *Sphinges* and *Sesia* (the Clear-winged Moth), appear the last of May. *Arctia Arge*, *A. virgo*, *A. phalerata*, and other species, fly from the last of May through the summer. *Hyphantria textor*, the Fall-weaver, is found in May and June. The moth of the Salt-marsh Caterpillar appears at this time, and various Cut-worms (*Agrotis*) abound, hiding in the daytime under stones and sticks, etc., while various Tineids and Tortrices, or Leaf-rolling Caterpillars, begin to devour tender leaves and buds and opening blossoms of flowers and fruit trees.

Fig. 2*b*. Fig. 2*a*. Fig. 2.

The White-pine Weevil (*Pissodes strobi*, Fig. 2 *a*, larva; Fig. 2 *b*, pupa; and Fig. 2, beetle) flies about in warm days. We have found its burrows winding irregularly over the inner surface of the bark and leading into the sap-wood. Each cell, in which it hybernates, in the middle of March, contains the yellowish-white

footless grub. Early in April it changes to a pupa, and a month after the beetle appears, and in a few days deposits its egg under the bark of old pine trees. It also oviposits in the terminal shoots of pine saplings, dwarfing and permanently deforming the tree. Associated with this weevil we found the smaller, rounder, more cylindrical, whitish grubs of the *Hylurgus terebrans* (Fig. 3), which mines the inner layers of the bark, slightly grooving the sap-wood. Later in April it pupates, and its habits accord in general with those of *Pissodes strobi*. Another Pine-weevil (*Hylobius pales*, Fig. 4) also abounds at this time.

Fig. 3.

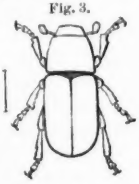
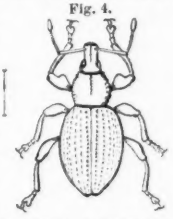


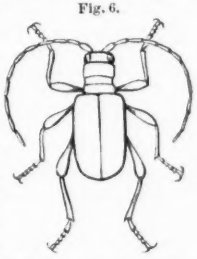
Fig. 4.



Cylindrical bark-borers, which are little round weevil-like beetles, are now flying about fruit-trees, to lay their eggs in the bark. Associated with the *Pissodes*, we found in April the galleries of *Tomicus pini*, branching out from a common centre. They are filled up with fine sawdust, and, according to Dr. Fitch, are notched in the sides "in which the eggs have been placed, where they would remain undisturbed by the beetle as it crawled backwards and forth through the gallery." These little beetles have not the long snout of the weevils, hence they cannot bore through the outer bark, but enter into the burrows made the preceding year, and distribute the eggs along the side (*Fitch*). Another *Tomicus*, more dangerous than the preceding, feeds exclusively in the sap-wood, running solitary galleries for a distance of two inches towards the centre of the tree. We figure *Tomicus xylographus* Say (Fig. 5). It is the most formidable enemy to the white pine in the North, and the yellow pine in the South that we have. It also flies in May. *Ptinus fur* (Fig. 6) is now found in out-houses, and is destructive to cloth, furs, etc., resembling the Larder-beetle (*Dermestes*) in its habits. It is fourteen-hundredths of an inch in length.

Fig. 5.

Fig. 6.



PROCEEDINGS OF SCIENTIFIC SOCIETIES.

ACADEMY OF NATURAL SCIENCES. *Philadelphia, Oct.* 1, 1867.—Dr. Hays exhibited a fine specimen of Malachite; he also exhibited several specimens of hair from Albino negroes. Dr. Leidy spoke of the white Albino, and mentioned that the term "wool" was a misnomer as applied

to the hair of the negro; the differences between the races being those pertaining to the form of the shaft.

Oct. 15th.—Dr. E. Coues, U. S. A., presented a paper entitled, "Notes on a Collection of Mammals from Arizona." Professor Holmes, of Charleston, exhibited specimens of fossil remains of extinct and recent animals, accompanied by bones of man, with pottery, stone arrow-heads, and hatchets from the postpliocene strata. He also called attention to the geology of the Charleston basin. Professor Leidy made some remarks in continuation of the subject; also noticed cases where the soft tissues of extinct animals have been preserved.

Oct. 22d.—Professor Wood presented some remarks on a fresh-water alga from the thermal springs in Mono county, California, which was said to grow in water having a temperature of from 120° to 136° F.

A paper was read entitled, "Notes on a Collection of Californian Myriapoda. with the description of a new *Lithobius* from Illinois," by Horatio C. Wood, jr.

Oct. 29th.—Mr. Lyman exhibited a map of the Pennsylvania coal regions, accompanied by remarks on the conglomerate formation of Sullivan county; he also called attention to the bending of a limestone post by its own weight, the specimen now being in the collection of the Academy.

Nov. 5th.—Dr. Leidy directed the attention of the members to a specimen of a fossil Peccary, *Dicotylus nasutus* Leidy. Professor Cope exhibited teeth of a new Cretacean, *Squalodon mento* Cope; specimens of the jaw of the *Squalodon atlanticus* Cope; also many bones of a new whale, which was named *Megaptera brachychira* Cope, with other fossils from the Miocene formation of Charles county, Maryland.

Nov. 12th.—Professor Cope read a paper entitled, "An addition to the Vertebrate fauna of the Miocene period of the United States." Dr Leidy read a letter from Professor Hayden, describing the Lignite beds of Laramy plains. Professor Cope spoke of the formation of natural coke which he had observed in Eastern Virginia. Dr. LeConte made remarks, illustrated by specimens, upon the tertiary coal-beds of New Mexico in the vicinity of the Rocky Mountains, and the Cretaceous coal-beds of the Rio Grande valleys. Both regions were regarded by him as capable of supplying abundant fuel for railroad, metallurgic, and manufacturing purposes. He also mentions beds in the vicinity of Denver of great thickness, from eleven to sixteen feet, free from impurities.

Boston Society of Natural History. *Oct.* 16, 1867.—Prof. Agassiz remarked upon the antiquity of man. He said that fifty years ago both the learned and unlearned believed they possessed a trustworthy chronology of human history. Historians struck the first blow at this assumption by their researches into the successive dynasties which had ruled over Egypt. Their lead was quickly followed in the different departments of science, until now we are forced to cast aside the ancient beliefs and construct our chronology from a new and independent basis.

Twelve years ago, Ferdinand Keller, of Zurich, by his examination of the lake deposits of Switzerland, brought to light proofs of the existence of races of men with new characters of civilization. These discoveries astonished the world, and have since given rise to a new science, new societies, and new museums. Humanity is now connected with geological phenomena.

Formerly the presence of such large mammals as the Elephas primigenius, Rhinoceros tichorinus, Bos primigenius and Ursus spelaeus, was considered the dividing line between geological and human history,— now the extensive researches of such able naturalists as Lartet, Von Baer, Rütimeyer, and Brandt, have proved that these quadrupeds were once contemporaneous with man. The question before us is whether we can establish a successive chronology of events since the appearance of these animals upon the earth. Brandt has attempted to show that they were living within the historical period, and has argued therefrom that the native cattle of Europe were developed from the Bos primigenius. The argument for their recent extinction is drawn from documents hitherto partly unknown, because written in the Sclavonic tongue; these represent the existence of Bos primigenius in the forests of Lithuania and Poland up to the 11th and 13th centuries. The presence of Cervus megaceros in the marshes of Europe up to the 14th century is also made probable.

There is no doubt that the fauna of the diluvial deposits and of the European caves consisted of animals, some of which, at least, had a circumpolar geographical distribution, and that the southern limits of animals now living in the polar regions was once much greater than now; remains of the reindeer have been found all through France to the Pyrenees and in Southern Germany. We find that these mammals had intimate relations with the ice period, and it becomes necessary for us to investigate the extent of the ice-fields at the time when the glacial period was at its height. Professor Agassiz believed that the changes in extent which our ice-fields have undergone during successive periods, would furnish us with data for our chronology. In America, the ice-fields, at the time of their greatest extension with indefinite limits, reached the 32d degree of north latitude. In Europe they extended as far as the plains of Lombardy. Subsequent to this came a limited glacial period, in which the Southern and Middle States were freed from glaciers, but from Maine westerly the country was still ice-bound. During a third period the ice retreated to the northern shores of Lake Superior and the slopes of Mt. Katahdin, while in a fourth period, the one before the present, the continent was clothed with vegetation up to the hilly parts of Canada.

In answer to the question whether we had any means of connecting chronology with these facts, it might be stated that none of the cave animals or the large mammals which have been mentioned, have been proved to exist prior to the time of the greatest extent of the ice-fields, and, as it can no longer be doubted that man lived contemporaneously

with these animals, he believed that, with the waning of the ice-period, began the era of primeval man. In the successive epochs of the ice, indicated by the retreating ice, we have a *relative* chronology; when we ask for more specific statements of age, we find ourselves at once at a loss for an answer. Some indications might be seen in the abrasions of rocks of unequal hardness, and instances were cited in illustration of this.

In the course of the discussion which followed these remarks, Professor Agassiz said he hoped for great results from the investigations now undertaking in our own country, and believed that marks of the reindeer would yet be found in the Carolinas.

CORRESPONDENCE.

J. H. F., New York. — There is unfortunately no complete work on American Cryptogamic Botany. For works on Lichens, however, see the NATURALIST, Vol. I, p. 326. You will find the English works of Mr. Cooke, noticed in this number, very useful.

F. W. W., Concord, Mass. — There is no complete American work on Taxidermy. See, however, NATURALIST, Vol. I, p. 160, 321.

O. F., Needham Plain, Mass. — For works on American Entomology, see NATURALIST, Vol. I, p. 160, 441, and the last number. Subscriptions to "The Guide to the Study of Insects," which will be published in the autumn, may be sent to us.

L. A. R., Bucks, Ohio. — The specimen you inclose is a fossil gigantic Club-moss, *Lepidodendron*, which occurs abundantly in the shale inclosing coal-beds. Specimens from your region would be very acceptable. The Kangaroo Mouse you speak of is the *Jaculus Hudsonicus*, an animal well known as inhabiting nearly all the United States. The species of *Dipodomys*, to which Dr. Coues refers in his papers in the NATURALIST, as "Kangaroo Rats and Mice," are not known to occur east of the Mississippi.

N. T. T., Bethel, Me. — The substance to which you refer is the fresh-water Sponge (*Spongilla fluviatilis*). It occurs commonly in the ponds and sluggish brooks and rivers of Maine, and southward.

BOOKS RECEIVED.

The American Beaver and his Works. By Lewis H. Morgan. 8vo. Philadelphia, 1868. J. B. Lippincott & Co.

An Address on the Propriety of continuing the State Geological Survey of California, delivered before the Legislature at Sacramento, Jan. 30, 1868; to which are appended two letters relative to the Progress of the Geological Survey, etc., etc. By Professor J. D. Whitney. San Francisco, 1868. 8vo. pp. 23, 14, 15, 14.

Papers from "The American Beaver." By W. W. Ely. Philadelphia, 1868. J. B. Lippincott & Co. 8vo. pp. 46—77, 287—306.

The Field. March 7, 14, 21. London.

Cosmos. February 15, March 7. Paris.

American Bee Journal. April. Washington.

Notes on a Collection of Mammals from Arizona. By Elliott Coues, M. D., U. S. A. 8vo. pp. 4.